

The Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1-19. (Canceled)

20. (Previously presented) A composition comprising a mesenchymal stem cell (MSC) incorporated with a nucleic acid which encodes a hyperpolarization activated, cyclic nucleotide gated 2 (HCN2) ion channel in an amount sufficient to create an ion channel in the MSC, wherein the MSC forms a gap junction with a cell of a mammalian heart.

21-48. (Canceled)

49. (Previously presented) A method of expressing a functional hyperpolarization activated, cyclic nucleotide gated 2 (HCN2) ion channel in a human heart comprising: (1) preparing the composition of claim 68; and (2) site-specifically introducing the composition directly into the heart by injection, microinjection, or catheterization, wherein the MSC forms a gap junction with a cell of the heart.

50. (Canceled)

51. (Previously presented) A method of treating a cardiac rhythm disorder in a human, wherein the disorder is at least one of conduction block, complete atrioventricular block, incomplete atrioventricular block or sinus node dysfunction, which method comprises site-specifically introducing directly into the human's heart the composition of claim 68 in an amount sufficient to induce pacemaker current expression at the site, wherein the composition is introduced by injection, microinjection, or catheterization, thereby treating the rhythm disorder in the human.

52-56. (Canceled)

57. (Previously presented) A method of inducing a pacemaker current in a human's heart which comprises site-specifically introducing directly into the human's heart the composition of claim 68 in an amount sufficient to induce a pacemaker current in the heart, wherein the composition is introduced by injection, microinjection, or catheterization, and further wherein the MSC forms a gap junction with a cell of the heart, thereby inducing a pacemaker current in the heart.

58. (Canceled)

59. (Previously presented) A method of inducing a pacemaker current in a human cardiomyocyte which comprises contacting the human cardiomyocyte with the composition of claim 68 in an amount sufficient to induce a pacemaker current in the cardiomyocyte, wherein the composition is introduced by injection, microinjection, or catheterization, and further wherein the cardiomyocyte forms a gap junction with the MSC, thereby inducing a pacemaker current in the cardiomyocyte.

60-64. (Canceled)

65. (Previously presented) A composition for delivering a pacemaker current to a mammalian heart comprising a mesenchymal stem cell (MSC) incorporated with a nucleic acid which encodes a hyperpolarization activated, cyclic nucleotide gated 2 (HCN2) ion channel in an amount sufficient to create an ion channel in the MSC and deliver a pacemaker current when site-specifically introduced directly into the heart, wherein the MSC forms a gap junction with a cell of the heart.

66. (Previously presented) A method of inducing a pacemaker current in a human's heart which comprises site-specifically introducing directly into the human's heart the composition of claim 69 in an amount sufficient to induce a pacemaker current in the heart, wherein the composition is introduced by injection, microinjection, or catheterization, and further wherein the MSC forms a gap junction with a cell of the heart, thereby inducing a pacemaker current in the heart.

67. (Previously presented) A method of inducing a pacemaker current in a human

cardiomyocyte which comprises contacting the human cardiomyocyte with the composition of claim 69 in an amount sufficient to induce a pacemaker current in the cardiomyocyte, wherein the composition is introduced by injection, microinjection, or catheterization, and further wherein the cardiomyocyte forms a gap junction with the MSC, thereby inducing a pacemaker current in the cardiomyocyte.

68. (Previously presented) The composition of claim 20, wherein the mesenchymal stem cell is a human mesenchymal stem cell.

69. (Previously presented) The composition of claim 65, wherein the mesenchymal stem cell is a human mesenchymal stem cell.